The rapid growth and increasing profitability of microfinance throughout the world have sparked calls for increased regulation. Existing literature on microfinance regulation has treated regulation as a binary variable, i.e., whether the Microfinance Institution (MFI) was being regulated or not. This approach, however, fails to capture the granularities associated with the regulations imposed on MFIs. In this paper, we study two specific relationships: (1) the indirect impact of traditional prudential regulation, as proxied by the Capital Adequacy Ratio (CAR) requirements, on the sustainability and profitability of MFIs; (2) the causal relationship between MFI outreach, represented by percentage of active female borrowers, and the MFI’s profitability. To demonstrate a causal link between outreach and profitability, we employed an instrumental variable approach, with sanitation as an instrument for MFI outreach. Our findings associate more stringent prudential regulation with increases in MFI profitability and decreases in outreach. Furthermore, our 2SLS results demonstrate a negative causal relationship between MFI outreach and profitability. Therefore, when imposing regulation on MFIs, emerging market policy makers should look beyond standard balance sheet items, and account for metrics such as an MFI’s percentage of women borrowers (PWB). Such a policy making framework allows regulators to account for the mission-oriented nature of MFIs, allowing them to strike the right balance between the sustainability and outreach of these firms.

1 Vincent Yu, Rahim Damji, Vrushank Vora, and Lokesh Anand are members of the class of 2014 at the University of Chicago.
1 Introduction: Microfinance

Microfinance Institutions (MFIs) bridge the financial inclusion gap in developing countries by providing poor individuals with capital in an effort to alleviate poverty. Originally started in the 1970s, the modern microfinance sector grew at unprecedented rates from 2004 to 2008, posting an average annual asset growth rate of 39% and accumulating total assets of over sixty billion U.S. Dollars (Chen et al., 2010). Today, MFIs reach over 100 million clients and have impressive repayment rates on loans. Through numerous studies, the benefits of economic empowerment through MFIs for the rural poor and women have far outpaced benefits from other programs in developed countries. Indeed, it is believed that approximately 5% of large MFIs’ clients, such as Grameen Bank in Bangladesh, exit poverty every year (Chowdry, 2009). The rapid growth of microfinance has prompted increased calls for regulations, but complying with these regulations can prove costly to the profitability and social mission of microfinance institutions.

There are obvious incentives for MFIs to have regulations. Although a default in an MFI does not pose a threat to a nation’s economic stability, these institutions accept deposits from the most impoverished individuals, unlike traditional banking authorities. In an effort to protect these deposits, governments around the world have expanded MFI regulations. While these requirements offer poorer individuals security, it is unclear what effects these regulations have on the sustainability of an MFI. Regulatory costs exhibit characteristics of economies of scale, and therefore are generally more costly for smaller microfinance institutions than for larger banks (Cull, Demirg-Kunt, Morduch, 2009). As a result, MFIs decrease their interest rates to offset the increased cost per dollar lent. This decrease accompanies the exclusion of potential borrowers, such as women and the rural poor, and thus discourages MFIs from bridging the financial gap in developed countries. In this paper, we are interested in investigating the relationship between regulation and sustainability of a microfinance institution.

1.1 Introduction: MFI Profitability

Profitability of a microfinance institution is a crucial determinant of sustainability in the long-run. When establishing regulations for MFIs, authorities must consider the impact of their policies on firm-level profitability, as it will determine long-term sustainability. In this section, we introduce metrics to assess the profitability of microfinance institutions. MFIs generally provide financial services to historically underbanked individuals in emerging markets. When measuring the profitability of MFIs, we can apply the same metrics that regulators use for measuring the performance of more traditional financial service providers. We will specifically focus on three important metrics for financial performance: Return on Assets (ROA), Return on Equity (ROE), and Real Yield on Gross Portfolio.

Return on Assets is defined as the ratio between an MFI’s net income and its total assets. It serves
as an indicator of how effective an MFI is at converting its money from debt and equity into net income. Generally speaking, the higher an MFI’s return on assets, the more efficient the institution is in utilizing its asset base and generating a profit. Similar to ROA, return on equity is a ratio between an MFI’s net income and the capital contribution from shareholders’ equity. It serves as an indicator of how effective an MFI is at converting its money from equity into net income. The higher an MFI’s ROE, the more efficient the institution is in utilizing its equity base and generating a profit. Ultimately, both metrics serve as indicators of an MFI’s management quality and whether the institution can generate sustainable profits over time. Portfolio yield, which is the third profitability indicator, is the ratio between interest payments in an MFI’s loan portfolio and the total value of the portfolio. Portfolio yield also indicates the type of clientele that an MFI serves. Higher yields indicate riskier and more under-banked clientele. Whereas ROA and ROE indicate whether an MFI can generate sustainable long-term profits, portfolio yield is an indicator of an MFI’s revenue during a specific period of time.

1.2 Introduction: MFI Outreach

Setting regulations ideally requires consideration of how effective a microfinance institution is in executing its stated mission of providing banking services to micro-enterprises and low-income families. Assessing the productiveness of outreach efforts is often hard to quantify, and goes beyond the customary balance sheet items reported by financial services firms. For the purposes of this paper, we used the percentage of active female borrowers as our metric for MFI outreach. This metric for outreach is consistent with existing microfinance literature.

Seventy percent of the world’s poor are women (Microcredit Summit Campaign Report, 2007). Commercial banks traditionally discriminate against high risk borrowers, which include women in developing countries due to their historical disenfranchisement. MFIs that target more women are inherently sorting for individuals that lack access to credit and financial services. Existing microfinance literature has shown that children of female microfinance borrowers also reap the benefits of increased access to credit, with increased school attendance and lower drop-out rates especially amongst girls (Harris, 2007). Moreover, as many women in developing countries have a non-existent credit history, MFIs are unable to properly assess these borrowers’ default risk, which makes lending to women more costly. Thus, most of the loans women receive are group loans, and most group loans are made in regions that are traditionally under- and unbanked (Cull, Demirg-Kunt, Morduch, 2009; Bannerjee et al., 2012). Given the historical disenfranchisement of women in developing countries and lack of a credit history, we used the percentage of active female borrowers as a proxy for MFI outreach. Within the context of this paper, MFIs with a higher percentage of active women borrowers are more effectively executing their mission of providing credit to unbanked markets, compared to their counterparts with a lower percentage of active women borrowers.
1.3 Introduction: Regulation of MFIs

Regulations on banks are meant to preserve their stability and protect public deposits (Carrasco, 2006). Because of information asymmetries between shareholders, debtors, and depositors, banks are generally more heavily regulated than other companies. Depositors are vulnerable to banks engaging in risky high-profit operations that threaten the security of their deposits. To counterbalance this vulnerability, regulations are placed on banks. These regulations either impose constraints on the bank to deter them from engaging in excessively risky activities, or provide the bank with a set of incentives to align their private objectives with their social goals (Carrasco, 2006). These regulations can be divided into two different types: prudential and non-prudential. Prudential regulation intends to preserve the stability of the bank by establishing penalties that deter institutions from taking excessive risks. Non-prudential regulation seeks to promote good behavior in the system by requiring consumer protection, information disclosure, and fair business practices (Llewellyn, 1999).

The arguments that favor the aforementioned regulations on banks extend to MFIs, especially since depositors of an MFI are in a disadvantaged position compared to clients at traditional banks. Because these depositors possess only a small amount of money, any failure of a MFI would discourage them from participating in the financial system indefinitely (Carrasco 2006). Furthermore, the regulation of MFIs serves as a mean to build the confidence of commercial banks in these institutions, which provide MFIs with a large portion of their funding. In the past, prudential regulations on MFIs have included minimum capital requirements, loan-loss provisioning, and ownership requirements. The regulation most relevant to MFIs is capital adequacy.

Capital adequacy requirements establish the maximum level of leverage that an MFI can reach on its operations and thereby limits the amount of risk that an MFI can have in its portfolio (Jansson, 1997). It is measured by the ratio of risk-weighted assets to equity. Originally proposed by the Basel Committee for large international banking institutions, capital adequacy requirements have been extended to MFIs. It is argued that capital adequacy requirements for MFIs should be higher, since microfinance portfolios are characterized by high volatility and scarce geographical diversification (Carrasco, 2006). On the other hand, some argue that these requirements are counterproductive for MFIs, as they generate lower levels of financial intermediation and therefore deter MFIs from serving the most economically disadvantaged.

1.4 Introduction: Research Approach

Given the contending theories about impact of regulation on MFIs, this paper attempts to answer the following questions: (1) What are the residual externalities associated with stricter traditional banking regulations on the sustainability of MFIs in emerging markets?, and (2) What is the impact of a higher percentage of active female borrowers on the profitability of a microfinance institution?
By answering the above questions, we hope to establish a policy decision-making framework for emerging market regulatory authorities. The remainder of the paper proceeds as follows: Section II surveys the existing literature on the impact of regulation on MFI s and then discusses our contributions to existing literature; Section III details the data sets used in the paper; Section IV reports the econometric analysis of these data sets along with our main findings; Section V concludes the study and discusses possible policy implications of our research.

2 Literature Review: Microfinance and Regulation

Compliance with traditional financial regulations could be particularly costly for microfinance institutions. For example, the costs of complying with regulation for US banks are immense, roughly 12-13% of non-interest expenses (Elliehausen, 1998). For MFI s, these additional costs can be even more extensive because of the high risk profile of MFI s’ borrowers. Regulatory costs, which increase the fixed costs of a firm, thus lead to distinct competitive advantage for larger banks, exhibiting economies of scale, over smaller banks such as MFI s (Murphy, 1980; Schroeder, 1985; Elliehausen & Kurtz, 1988).

MFI s also face unique challenges in operating their business model. MFI s have a homogeneous loan portfolio with little-or-no credit individuals serving as borrowers; in order to maintain profitability and spread default risks, MFI s must be able to underwrite a higher number of loans. MFI s thus operate in an environment where customers are without credit histories or necessarily predictable borrowing behaviors. This business model encourages MFI s to compromise profitability by giving out as many loans as possible to under-banked individuals with minimal concern for default risks. Cull, et. al, 2011, found that onsite bank supervision encourages institutions to maintain profitability through curtailing the outreach of MFI s towards women and traditionally costly-to-reach customers.

Furthermore, regulations are likely to affect MFI s in different ways, depending particularly on their for-profit or non-profit status. Typically, MFI s fall into four categories: Bank, Credit Union (CU), Nongovernmental Organization (NGO), or Non-Bank Financial Institution (NBFI). The first two generally fall into the category of for-profit institutions. NGOs are traditionally non-profit institutions. NBFIs can be either, but are regulated as a for-profit bank, allowing them to assume additional roles like taking deposits.

Changes in regulations, such as an increase in CARs, lead to different operating procedures between for-profit and non-profit banks (Cull, Demirguc-Kunt, Murdoch, 2009). Because of differing goals non-profit banks serve a greater proportion of borrowers, in particular women, than for-profit banks. A major drawback to microfinance lending is the high fixed transaction costs that accompany numerous loans with minimal face values. Thus, profit sensitive companies are more inclined to loan larger amounts
to a smaller and wealthier subset of the population. Additionally, for-profit companies are much less likely to loan to women than non-profit companies, even though loans to women would most likely have a larger social impact in a developing nation.

Though for-profit institutions are generally more selective about their loans than non-profits, the actual profitability of the two institutions is closer than one would expect. Cull et al. found that 73% of banks are profitable, while 54% of NGOs are profitable. However, more NGOs than banks were included in their sample, and more customers were served by profitable NGOs than profitable banks. Banks also charge lower interest rates (due to their greater selectivity) and provide higher quality services to their customers, (which are more expensive than the minimal service provided by NGOs), while NGOs have lower borrowing costs (due to interest free loans from socially conscious investors). Thus, on average, profitability is relatively similar between the two.

Existing literature on this topic has treated regulation as a binary variable, i.e., whether the MFI was being regulated or not. This approach fails to capture the granularities associated with the regulations imposed on MFIs. In this paper, we use Capital Adequacy Ratio (CAR) as a proxy for quantifying prudential regulation. By studying the association between CAR and sustainability of MFIs, we can better understand the regulation of MFIs. We hypothesize that prudent regulation, particularly capital adequacy requirements, can actually make banks more profitable. Higher CAR indicates stricter prudential regulation, and can be linked to increases in profitability, while diverting the loan portfolio of MFIs from their target client-base: the traditionally under and unbanked.

Additionally, we also studied the causal relationship between percentage of female borrowers and the profitability of MFIs. This relationship, however, is inherently endogenous as there could be reverse causality between return on assets and percentage of female borrowers of an MFI. To demonstrate a causal link between outreach and profitability, we employed an instrumental variable approach. We collected data on sanitation access and quality for countries where the MFIs in our dataset are operating. Our 2SLS results show that there is a significant negative relationship between the percentage of active women borrowers and profitability, i.e., increases in percentage of active women borrowers leads to significant decreases in firm-level profitability. Studying this relationship allows us to recommend a policy making framework for regulating MFIs. Particularly, when establishing a regulatory framework for MFIs,

---

2 Cull et al. found that the median loan size of for-profit banks as a percentage of income at the 20th percentile was 294% (compared to 60% for NGOs) indicating that for-profits serve a much lower portion of the poor and very poor. One benefit to this strategy is lower interest rates (as more selective loans have lower risks) as Real portfolio yield (i.e. average interest rate charged) for banks was 14% compared to 26% for NGOs.

3 Just 6% of female borrowers obtained loans from for-profit banks in Cull, Demirguc-Kunt, Murdoch’s data.

4 Cull et al. found an insignificant correlation between average loan size and profitability of a MFI.
emerging market policy makers should look beyond standard balance sheet items and consider an MFI’s percentage of female borrowers. This accounts for the mission-oriented nature of MFIs.

3 Data: Summary Statistics

This study used data from both the Microfinance Information Exchange as well as the World Bank. We specifically employed three different datasets: a dataset from Microfinance Information Exchange (MIX) for firm level characteristics of MFIs; a World Bank data set on capital adequacy requirements for individual countries; and a World Bank data set on access to sanitation index by country.

3.1 Microfinance Information Exchange (MIX) Dataset

The Microfinance Information Exchange was used to gather 13,366 data points representing 2,409 microfinance institutions from 1995 to 2012. Each data point contained information about a particular MFI in a given year. This information included the following:

- MFI Performance Characteristics: Debt to Equity ratio, the value of the firm’s assets, its return on equity, its return on assets, and the yield on its gross portfolio, loan loss rate, write-off rate, and percentage of active women borrowers.

- MFI Operational Characteristics: the location of the firm’s operations, age, scale, target market, number of personnel employed, profit status, legal status, and whether the firm was regulated or not regulated.

<table>
<thead>
<tr>
<th>Countries: 119</th>
<th>MFIs</th>
<th>Profit</th>
<th>Non-Profit</th>
<th>Regulated</th>
<th>Non-Regulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Countries</td>
<td>2412</td>
<td>892</td>
<td>1520</td>
<td>1579</td>
<td>833</td>
</tr>
<tr>
<td>India</td>
<td>190</td>
<td>64</td>
<td>126</td>
<td>124</td>
<td>66</td>
</tr>
<tr>
<td>Mexico</td>
<td>81</td>
<td>69</td>
<td>12</td>
<td>5</td>
<td>64</td>
</tr>
<tr>
<td>Ecuador</td>
<td>58</td>
<td>4</td>
<td>54</td>
<td>18</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 1: Summary Statistics: MIX Data

For the purposes of our paper, we only used the most recently available MFI data, in this case between 2008-2009, and only considered MFIs that were regulated. One of the weaknesses in this data set is the presence of an upward skew. The MFIs that are likely to report such extensive data are more likely have the resources necessary to absorb the costs of prudential regulation without decreasing their outreach to most economically-disadvantaged. Thus, even if we do not find evidence that these banks decrease their outreach due to an increase in capital adequacy requirements, we cannot conclude that increases in these requirements would not affect outreach for smaller MFIs with less available resources. Conversely, if we do find evidence from this data set that MFIs decrease outreach due to an increase in capital adequacy
requirements, we could presume that an increase would cause smaller MFIs to more severely curtail their outreach.

<table>
<thead>
<tr>
<th>Ratios</th>
<th>Min</th>
<th>1st Q</th>
<th>Median</th>
<th>2nd Q</th>
<th>3rd Q</th>
<th>Max</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Assets (%)</td>
<td>-169.00</td>
<td>0.00</td>
<td>2.00</td>
<td>1.19</td>
<td>4.00</td>
<td>29.00</td>
<td>10.18</td>
</tr>
<tr>
<td>Return on Equity (%)</td>
<td>-212.00</td>
<td>1.00</td>
<td>9.00</td>
<td>12.99</td>
<td>22.00</td>
<td>1128.00</td>
<td>60.96</td>
</tr>
<tr>
<td>Yield on Gross Portfolio (%)</td>
<td>-8.00</td>
<td>12.00</td>
<td>18.00</td>
<td>21.35</td>
<td>25.00</td>
<td>104.00</td>
<td>16.53</td>
</tr>
<tr>
<td>Write Off Ratio (%)</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>1.93</td>
<td>2.00</td>
<td>24.00</td>
<td>3.25</td>
</tr>
<tr>
<td>Active Female Borrowers (%)</td>
<td>9.00</td>
<td>42.00</td>
<td>59.00</td>
<td>63.085</td>
<td>89.75</td>
<td>100.00</td>
<td>26.59</td>
</tr>
</tbody>
</table>

Table 2: Summary Statistics: MIX Data

<table>
<thead>
<tr>
<th>Minimum</th>
<th>1st Quartile</th>
<th>Median</th>
<th>Mean</th>
<th>3rd Quartile</th>
<th>Maximum</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>8.00</td>
<td>9.00</td>
<td>8.90</td>
<td>10.00</td>
<td>12.00</td>
<td>2.95</td>
</tr>
</tbody>
</table>

Table 3: Summary Statistics: Capital Adequacy Ratio

3.2 World Bank Data: Capital Adequacy Requirements and Access to Sanitation

From the World Bank website, we gathered data on capital adequacy regulations from 2008 to 2010. Since we are concerned specifically with prudential regulation, data on capital adequacy requirements by country allowed us to study regional specific granularities and quantify the impact on prudential regulation.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>1st Quartile</th>
<th>Median</th>
<th>Mean</th>
<th>3rd Quartile</th>
<th>Maximum</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.00</td>
<td>58.00</td>
<td>82.00</td>
<td>74.26</td>
<td>89.00</td>
<td>100.00</td>
<td>21.20</td>
</tr>
</tbody>
</table>

Table 4: Summary Statistics: Improved sanitation facilities (% of population with access)
Lastly, we collected data on quality and access to sanitation facilities for countries in which MFIs in our mix-data set are operating. The World Bank’s data on improved sanitation facilities measure the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. We used this data set when employing an instrumental approach to infer a causal link between percentage of female borrowers and profitability of an MFI.

4 Econometric Analysis

4.1 OLS: Profitability

Although higher capital adequacy requirements ordinarily restrict the profitability of financial services in the developed world, we hypothesize that MFIs do not ordinarily profit-maximize and instead also focus on their mission of delivering services to the traditionally under-banked. Because we used capital adequacy requirements as a proxy measure for other prudential regulations, we believe that states with higher requirements will also enforce a host of other prudential regulations, such as interest rate caps, liquidity constraints, increased supervision through regular stress tests, and loan guidance.

As such, we believe that stricter prudential regulations will incentivize MFIs to focus their client base upon less risky clients, consequently increasing their profitability. We thus expect the following relations: either MFIs in states with higher capital adequacy requirements have lower yields on their gross portfolios, indicating a more credit-transparent client base, or MFIs in states with higher requirements have higher return on assets indicating increased profitability. In other words, even though we might not expect a direct causal link between capital adequacy requirements and profitability, the other more strict prudential regulations that come with higher requirements may be more directly linked with the higher return on assets and lower gross portfolio yields.

4.2 OLS: Mission

Next, we looked at the link between higher capital adequacy requirements and percentage of female borrowers (PFB) within a MFI’s portfolio. As noted above, an increase would incentivize an MFI to reduce its exposure to more risky assets, thus reducing their loans to female borrowers, who most likely have weaker credit histories and less stable incomes. PFB is correlated with loans to the most economically disadvantaged as most female MFI clients are members of small villages who utilize “group lending” to secure loans (making multiple borrowers liable for individual loans). Thus, if capital adequacy requirement or other prudential regulations for which it proxies, affect the PFB, they likely have greater effects on diminishing the overall outreach of microfinance to the most economically disadvantaged, and thus the MFI’s mission.
4.3 **OLS: Controls**

We included several controls for our regulations:

1. Assets as a proxy for firm size;
2. Debt to equity as a proxy for capital structure;
3. Financial expense over assets as a proxy for operational efficiency;
4. Country to control for characteristics such as regulation culture, banking culture, opportunities for MFIs to exist, etc.;
5. Year to control for time-structural changes such as global economic changes in the MFI industry;
6. Profit status as profitability and mission priorities across non-profits and for-profits are different (non-profits were found to have higher percent of women borrowers and lower profit measures [Cull, Demirg-Kunt, Morduch, 2009]).

We had to keep in mind that capital adequacy requirements’ effect on profitability and PFB may be correlated with a Country effect, a Year Effect, as well as the individual business characteristics of the MFIs, thus we added these covariates to the regression in order to minimize omitted variable bias.
4.4 Main Results

We ran this regression on ROA using CAR:

\[
ROA_i = \beta_0 + \beta_1 CAR_i + \gamma_1 Assets_i + \gamma_2 FEA_i + \gamma_3 DE_i + \gamma_4 Country_i + \gamma_5 PS_i + \gamma_6 Year_i + \epsilon_i
\]

Controls

\[i = \text{Microfinance Institution}\]

\[ROA = \text{Return on Assets}\]

\[CAR = \text{Capital Adequacy Ratio}\]

\[FEA = \text{Financial Expense Assets}\]

\[DE = \text{Debt to Equity Ratio}\]

\[PS = \text{Profit Status}\]

| Estimate  | Std. Error | t value | Pr(>|t|) |
|-----------|------------|---------|----------|
| (Intercept)| 22.4115    | 10.5595 | 2.12     | 0.0344   |
| Capital Adequacy Ratio | 10.8619 | 2.9239 | 3.71 | 0.0002 |

Adjusted R-Squared: 0.2034

Number of Observations: 1052

Table 5: Impact of Capital Adequacy Ratio on Portfolio Yield

Our results showed a significant positive relation with Return on Assets (beta = 10.86, t value = 3.71, P=.0002). Following this, we ran a regression on real yield of gross portfolio using CAR (after seeing heteroscedasticity and no autocorrelation in the original graph, we ran this with a Huber-White correction):

\[
Yield_i = \beta_0 + \beta_1 CAR_i + \gamma_1 Assets_i + \gamma_2 FEA_i + \gamma_3 DE_i + \gamma_4 Country_i + \gamma_5 PS_i + \gamma_6 Year_i + \epsilon_i
\]

Controls

\[i = \text{Microfinance Institution}\]

\[CAR = \text{Capital Adequacy Ratio}\]

\[FEA = \text{Financial Expense Assets}\]

\[DE = \text{Debt to Equity Ratio}\]

\[PS = \text{Profit Status}\]
Our results showed a significant negative relation of CAR with yield (beta = -7.89, t value = -5.29, P = .00). Next, we ran a regression on write-offs using CAR:

\[ \text{Write-Offs}_i = \beta_0 + \beta_1 \text{CAR}_i + \gamma_1 \text{Assets}_i + \gamma_2 \text{FEA}_i + \gamma_3 \text{DE}_i + \gamma_4 \text{Country}_i + \gamma_5 \text{PS}_i + \gamma_6 \text{Year}_i + \epsilon_i \]

Controls

\( i = \text{Microfinance Institution} \)

\( \text{CAR} = \text{Capital Adequacy Ratio} \)

\( \text{FEA} = \text{Financial Expense Assets} \)

\( \text{DE} = \text{Debt to Equity Ratio} \)

\( \text{PS} = \text{Profit Status} \)

| Estimate | Std. Error | t value | Pr(>|t|) |
|----------|------------|---------|----------|
| (Intercept) | -12.0299 | 3.2336 | -3.72 | 0.0002 |
| Capital Adequacy Ratio | -4.0545 | 0.8954 | -4.53 | 0.0000 |

Number of Observations: 1052
Adjusted R-Squared: 0.2681

Table 7: Impact of Capital Adequacy Ratio on Write-Offs

Our results showed a significant negative relation with write-offs (beta = -4.0545, t value = -4.53, P = .0000). This supports our hypothesis: clients that were less risky (demonstrated by the decrease in write-offs), but also less profitable (demonstrated by the decrease in yields) were sought out in states with higher capital adequacy requirements, and thus stricter prudential regulations in general. However, we also saw an increase in return on assets: MFI profitability correlated with CAR—supporting our larger thesis that the CARs would ultimately link to MFIs with more prudent loan portfolios (through a decrease in write-offs, and
yields, combined with an increase in profitability). We also ran a regression on percent of women borrowers using CAR:

$$PW_B = \beta_0 + \beta_1 CAR_t + C\gamma + \epsilon_i$$

where $PW_B$ is the Percentage of Female Borrowers, $CAR$ is the Capital Adequacy Ratio, $C$ is a matrix of controls as before, and $\epsilon_i$ is the error term.

| Estimate  | Std. Error | t value | Pr(>|t|) |
|-----------|------------|---------|----------|
| (Intercept) | 12.2750    | 19.2564 | 0.64     | 0.5242   |
| Capital Adequacy Ratio | -13.7010   | 5.3320  | -2.57    | 0.0105   |

Number of Observations: 1052
Adjusted R-Squared: 0.612

Table 8: Impact of Capital Adequacy Ratio on Percentage of Female Borrowers

Our results showed a significant negative effect of CAR on PFB (beta = -13.70, t value = -2.57, p = .01), which supported our hypothesis. This suggests that within our sample, MFIs in countries with higher capital adequacy requirements lent to female borrowers less often. Although CAR may not have been the direct cause of this effect, factors with which CAR correlates (such as higher prudential regulation) may decrease the outreach abilities of MFIs, as they incentivize these firms to provide less risky loans.

4.5 Difference-in-Difference: Assessing Causality

Next, we looked at the impact of changing CAR (our proxy for a change in prudential regulation) on MFIs, particularly with regards to its effect on ROE. An important consideration when passing regulation is its immediate effect on the financial standing and sustainability of affected firms. Since capital adequacy requirements and other prudential regulations are not presumably passed with effects on microfinance in mind, it is important to investigate how significantly the residual effects of such laws impact these socially conscious firms.
We expected that an increase in CAR from one year to another would increase a MFI’s ROE (as they would make less risky loans). In order to analyze this effect, we used the Difference in Difference Estimator (DD).

\[ ROE_i = \beta_0 + \beta_1 \text{treatment}_i + \beta_2 \text{time}_i + \beta_3 (\text{treat}_i \times \text{time}_i) + \epsilon_i \]

\[ \text{ROE} = \text{MFI's Return on Equity} \]

\[ \text{Treatment} = 1 \text{ if there is an increase in CAR of MFI's Operational Country between 2009 and 2010; 0 otherwise} \]

\[ \text{Time} = 1 \text{ if year is 2010; 0 for 2009} \]

We then ran the regression of ROE on year, bucket, and (time*treat), as well as our controls, in order to get the DD estimator for the change in CAR. Unfortunately, our DD estimator was not significant (p-value 0.15). This means that within our data, firms ROE was not significantly affected by a change in CAR year on year.

|                     | Estimate | Std. Error | z value | Pr(>|z|) |
|---------------------|----------|------------|---------|----------|
| (Intercept)         | 0.07     | 0.02       | 3.39    | 0.00     |
| Year                | 0.12     | 0.06       | 1.96    | 0.05     |
| Treatment           | 0.08     | 0.06       | 1.36    | 0.18     |
| Year*Treatment      | -0.12    | 0.09       | -1.42   | 0.15     |

Table 9: Results of Differences-to-Differences Regression
However, this does not conclusively mean that a change in CAR has no year on year effects. In fact, it would be interesting to test how a change in CAR affects the marginal firms, i.e. firms with Equity/Assets ratio (EA) close to CAR. Interestingly, as opposed to traditional banks, many MFIs do not have an EA near CAR (see Comparison of CAR to Capital Asset ratios). Thus, we subsetted our data to contain only firms with EA near CAR (+ or -.02). However, the data set was not sufficient to make meaningful estimates. We hypothesized that a regression on this subset would deliver a more meaningful estimate, as the beta for a change in CAR would be theoretically much higher for these firms than those with EAs well above CAR, which are probably much less concerned with the capital structure of their socially geared enterprises.

4.6 Instrumental Variables

Thus far, we have discussed the relationship between prudential regulation and sustainability. In this section, we discuss the causal relationship between MFI outreach and profitability. We specifically studied how changes in MFI outreach affect MFI profitability. Particularly, a causal link between outreach and profitability indicates that policy makers should look beyond standard prudential regulations when regulating MFIs. From the perspective of MFI regulatory authorities, knowledge of this relationship is crucial when imposing regulation that will impact the long-term sustainability of MFIs. Without understanding the granularities associated with the impact of outreach on MFI profitability, policy makers can unknowingly set prudential regulations that could significantly curtail the social impact that can be made by MFIs.
As discussed above, stringent prudential regulation requirements have been associated with increases in profitability and decreases in outreach. For the purposes of this section of the paper, we estimated the following equation:

$$ROAi = \beta_0 + \beta_1 PWBi + C\gamma + \epsilon_i$$

The above equation, however, is clearly endogenous due to reverse causality between the return on assets of an MFI and the percentage of active female borrowers that an MFI has. Considering that an increase in the percentage of female borrowers decreases profitability, as lending to women, on average, is costlier. On the other hand, if an MFI wants to increase its profitability, then it would naturally stop lending to costlier borrowers. This required us to estimate the above model using an instrumental variable approach.

Since we studied the impact of having a high percentage of women borrowers on MFI profits, the ideal instrument would correlate with the MFI’s percentage of female borrowers, but is uncorrelated with the profitability of the MFI. Theoretically, sanitation satisfies both the relevance and exogeneity conditions for a valid instrument. Consider that the percentage of active women borrowers of an MFI is conditioned upon the disenfranchisement of women in the region that the MFI operates. In most underdeveloped countries, women are primarily responsible for the use and management of water resources and sanitation at the household level. Hence, in developing countries, areas with high access to sanitation would lead to decreases household level responsibilities of women, allowing them to pursue micro-enterprises and demand credit access. Poor sanitation quality will be associated with the economically disadvantaged, with which we used the proxy, percent of women borrowers. Moreover, lower accessibility to sanitation is associated with higher poverty in that region. In the most impoverished regions, women are also likely to be more disenfranchised, and thus would demand micro-credit or microfinance loans. We thus have demonstrated that an MFI’s percentage of female borrowers is directly correlated with sanitation quality in the MFI’s area of operations. On the other hand, access to sanitation cannot directly affect an MFI’s return on assets. The only way sanitation quality can affect the ROA is through regional poverty levels as proxied by percent of female borrowers. Furthermore, for larger and more international MFIs, there would be enough diversification amongst its asset classes and clientele that sanitation cannot directly impact an MFI’s ROA.

The first stage of our instrumental variable approach is thus given by:

$$PWBi = \alpha_0 + \alpha_1 Si + C\gamma + \delta_i$$

$$Si = \text{Access to Sanitation in the region MFI is operating}$$
As described above, the assumptions for a valid regression are satisfied:

- **Relevance**: \( \text{Cov}(S, PW) = 0 \) because poor sanitation quality (lower percentage) will be associated with the economically disadvantaged, with which we use the proxy, percent of women borrowers. Thus, poor sanitation is associated with higher poverty which is associated with women borrowers.

- **Exogeneity**: \( \text{Cov}(S, ROA) = 0 \) because sanitation controls can only affect regional poverty levels as proxied by percent of female borrowers.

Our results for the 1st stage least squares are summarized below. Note that we have a significant value for our \( \beta \) estimate and the F-statistic and Wald Test on our first staged regression, which further justifies the use of sanitation as an instrument.

| Estimate  | Std. Error | t value | Pr(>|t|) |
|-----------|------------|---------|----------|
| (Intercept) | -11.5153 | 31.0819 | -0.37 | 0.7111 |
| Sanitation | -0.0028 | 0.0004 | -7.54 | 0.0000 |
| Year | 0.0061 | 0.0155 | 0.40 | 0.6916 |
| Total Expense | 0.1769 | 0.0382 | 4.63 | 0.0000 |
| Profit Status:Profit | -0.0301 | 0.0166 | -1.81 | 0.0700 |
| Age: New | 0.0029 | 0.0334 | 0.09 | 0.9300 |
| Age: Young | 0.0002 | 0.0226 | 0.41 | 0.6846 |
| Debt to Equity Ratio | 0.0002 | 0.0004 | 0.53 | 0.5989 |

Number of Observations = 1052
F-statistic: 11.05; Wald Test=182.3
Adjusted R-Squared: 0.063
Table 10: Results of 1SLS

The next table summarizes the results from our second stage regression:

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Return on assets</td>
</tr>
<tr>
<td>Year</td>
<td>0.005 (0.007)</td>
</tr>
<tr>
<td>Total Expense Assets</td>
<td>−0.593*** (0.020)</td>
</tr>
<tr>
<td>Profit Status: Profit</td>
<td>0.017** (0.008)</td>
</tr>
<tr>
<td>Age: New</td>
<td>0.016 (0.015)</td>
</tr>
<tr>
<td>Age: Young</td>
<td>0.048*** (0.010)</td>
</tr>
<tr>
<td>Debt to Equity Ratio</td>
<td>−0.00005 (0.0002)</td>
</tr>
<tr>
<td>Percent of Female Borrowers</td>
<td>−0.187*** (0.061)</td>
</tr>
<tr>
<td>Constant</td>
<td>−10.228 (14.358)</td>
</tr>
</tbody>
</table>

Observations 1,052
R² 0.487
Adjusted R² 0.483
Residual Std. Error 0.115 (df = 1044)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 11: 2SLS Results

4.7 Instrumental Variables: Discussion of Our Results

From our 2SLS results, we can infer that there is a significant negative relationship between percentage of active female borrowers and the profitability of a MFI. Given that increases in percentage of active women borrower causes a decrease in MFI’s profitability, MFIs actively sacrifice their social responsibility to increase their profitability. When authorities thus impose regulations that affect MFI profits, they indirectly cause MFIs to sacrifice their social mission. Emerging market policy makers should thus look beyond standard balance sheet items and consider an MFI’s percentage of women borrowers. This way, they account for the mission-oriented nature of MFIs. Some of the ways MFI regulators can establish regulations in line with MFIs’ mission-oriented nature is to set a minimum requirement for the percentage of female borrowers to grant MFI status, less strict capital requirements for MFIs with high percentage of women borrowers, and possible subsidies for MFIs with higher percentage of women borrowers.
5 Conclusion

The contemporary literature on microfinance up to now contained little empirical discussion of the effect that prudential regulations would have on MFI profitability and outreach. Since MFIs are financial institutions, microfinance regulation has been treated as regulation in regards to certain supervisory methods, rather than the gamut of regulations that MFIs face. To better explain the impact of regulation on MFIs, we used 13,366 data points representing 2,409 MFIs from 1995 to 2012, in combination with a World Bank database of capital adequacy measures and sanitation levels across countries, which allowed us to study the heterogeneity in the regulatory standards.

We studied two specific relationships: (1) the link between traditional prudential regulation, as proxied by the Capital Adequacy Ratio (CAR) requirements of regulatory authorities, on the sustainability of MFIs; (2) the causal relationship between MFI outreach, as proxied by percentage of active female borrowers of a MFI, and its profitability. Finding appropriate instrumental variables is clearly difficult, as the characteristics regarding poverty and loan clientele are likely to be endogenous in profitability regressions. As such, we offer an instrumental variable approach to assess causality by using sanitation as an instrument for MFI outreach.

Our research is consistent with and further expands existing literature on MFI regulation. We show that (1) stringent prudential regulation is associated with higher MFI profitability and lower outreach, as MFIs generally respond to prudential supervision by curtailing their outreach to segments of the population that are costlier to serve; (2) the IV approach demonstrates there is a significantly negative causal relationship between MFI outreach and profitability; (3) explicit prudential regulation targeted at larger financial firms compromises MFI outreach while increasing profitability.

Therefore, when imposing regulation on MFIs, emerging market policy makers should look beyond standard balance sheet metrics and profitability and account for outreach measures metrics such as an MFI’s percentage of women borrowers. Such a policy-making framework allows regulators to account for the mission-oriented nature of MFIs. Current regulations on MFIs have been linked to increases in MFIs’ financial performance at the expense of MFIs’ outreach efforts, as they curtail lending to women and other costlier market segments. Despite our economic results, it remains to be seen whether the benefits of explicit supervision through deposit or service protection outweigh the reductions in loan outreach.
Bibliography


Greg Chen, Stephen Rasmussen, and Xavier Reille. “Growth and Vulnerabilities in Microfinance.” *Consultative Group to Assist the Poor* 61 (2010).”


